

The knee

- Attacks of rheumatoid arthritis are twice as common in the knee joint as in the hip joint.
- Synovectomy usually has good effects on pain, swelling, and mobility, and there are advantages in using arthroscopic methods.
- Arthroplasty usually involves the use of a tri-compartmental prosthesis, and approximately 400 prosthetic procedures are performed annually in Sweden.
- The use of tricompartmental prostheses, modern instruments, and appropriate soft tissue management nearly eliminates the need for hinged prostheses.
- Patellar components have no effects on pain relief or function.
- Rehabilitation is usually lengthy, but uncomplicated. The ultimate effects on mobility and pain cannot be assessed before one year postoperatively.
- A low rate of loosening is reported in arthroplasty that involves the use of a tricompartmental prosthesis, and the total cumulative revision risk is 10% after 10 years.
- Knee prostheses are modified often. Hence, the models used in studies with reasonable followup times are usually no longer available on the market.

Swelling and impaired motion are early signs of arthritis in the knee, while limited movement and deformities appear later as a consequence of cartilage and bone loss. Severe instability is seldom a problem. Some patients may experience several years of productive synovitis causing pain and limiting movement, but causing only negligible damage to joint cartilage. So called Baker's cysts also belong to this group, ie, filling of a bursa be-

hind the knee, which may dissect far down into the calf.

Arthritis in one or both knees limits walking ability at an early stage. The most common deformity is a flexion contracture, often deteriorating further by sitting in a wheelchair. With time, it is often combined with a valgus deformity due to a relatively greater loss of cartilage-bone in the lateral joint compartment. Valgus rotation contractures of the lower leg are also rather common and must be considered, particularly in association with prosthetic surgery. More rarely, patients demonstrate hyperextension secondary to stretching of the posterior articular capsule, probably from bulky synovitis. All types of deformities sooner or later become fixed due to contraction of ligaments and the articular capsule on the short side.

Due to disturbances in the mechanical axis of the lower extremity, arthrosis secondary to inactive arthritis is especially common in the knee. This can lead to varus malalignment.

Magnitude of the problem

Manifestations in the knee are uncommon at the onset of arthritis, but eventually nearly 90% of the patients are affected [16]. Consequently, the knee is affected twice as often as the hip. A Swedish national registry of operated patients includes 20 years of data on knee arthroplasty [28,29]. The number of operated patients has been nearly constant, around 400 per year, as opposed to arthrosis, where a substantial increase has been observed. The mean age of operated patients has increased by approximately 2 years over the past 10 years [50].

Indications and surgical methods

The knee is the joint most often subjected to intraarticular steroid injections. As a rule, such injections effectively alleviate synovitis, and the need for surgical intervention can probably be postponed for shorter or longer periods. However,

once cartilage-bone destruction begins, the course toward progressive deformity and impaired mobility is relatively rapid.

Although the preventive effects of synovectomy can be questioned, the removal of large masses of tissue in the joint has biomechanical advantages [10,36]. Generally, pain relief can be achieved (Table 1). Open surgical methods have, in recent years, been increasingly replaced by arthroscopic methods, which seemingly provide more radical procedures, shorter rehabilitation times, and equally favorable clinical results [35]. Swedish experience with injected radioactive isotopes (dysprosium-165, gold-198, yttrium-90) is limited, but such methods have been used with relatively high frequency in the United States [6,57]. In some cases, synovectomy may be indicated to cure Baker's cysts.

Prior to the prosthetic knee era, various procedures were tested to reduce the effects of arthritis-induced joint damage and to restore joint function. Most of these procedures have been retired, eg, primary arthrodesis due to poor acceptance of an immobile knee and double osteotomy (above and below the knee) due to poor results [53].

Posterior capsulotomy, ie, dissection of the posterior capsule, can be performed to release a knee contracture without cartilage damage. However, Ishikawa et al found that despite a positive effect on the extension defect, the procedure caused pain, instability, and subluxation, resulting in a need for additional surgery in most patients within 1 year [23]. Even pronounced flexion contracture and a valgus malalignment can be successfully corrected by prosthetic surgery. Consequently, previously common procedures involving isolated soft tissues around the knee are now rarely used.

Patellectomy can be used to treat knee pain and joint destruction localized to the kneecap. The same joint can, however, be easily replaced by prosthetic knee surgery, and studies of nonrheumatic patients who have undergone patellectomy reveal an increased risk for complications in later prosthetic surgery. This increased risk is due, in part, to difficulties in centralizing the extensors, and, in part, to impaired strength and stair walking ability, plus the increased risk for falls and fractures near the knee [26]. The rheumatic process is seldom localized to only a part of a joint, which is

why isolated primary patellectomy cannot be recommended. The procedure may, however, have a place in treating certain complications of prosthetic knee surgery.

Corrective osteotomy may, in exceptional cases, be justified in rheumatics where it may be desirable to reposition the knee joint without using prosthetic knee surgery. These procedures may involve either varus and valgus angles or extensions. The latter, however, results in a degree of malalignment in the joint that makes later prosthetic intervention substantially more difficult.

The main indication for *knee arthroplasty* is pain resulting from cartilage and bone damage, but other indications may include prevention related mainly to valgus deformity resulting in imbalanced stress on the ankle and foot.

Knee prostheses were introduced as small joint surface replacement components replacing one (uni) or two (double uni) joint compartments. Recent advancements have generated prostheses that directly replace the joint surfaces on the three joint compartments of the knee, so called tricompartmental prostheses (tri). At an early stage, hinged prostheses were used to replace the total knee, including ligament functions. These prostheses were anchored with shafts in the medullary cavities. More advanced prostheses with rotational hinges allow not only flexion but even some rotation, permitting more natural mobility with less force on the implant and the implant-cement and cement-bone interfaces. Some tricompartmental prostheses have interconnecting parts to enhance the stability of the prosthesis, partly to replace the function of the posterior cruciate ligament (so called "posterior stabilized" prostheses), partly to replace the collateral ligaments (so called super-stabilized prostheses). Prostheses are affixed to the bone with bone cement or directly to bone, so called biological anchorage.

During the 1970s, the full range of prosthetic devices were used in Sweden, but with the introduction of modern tricompartmental prostheses, these have become the predominant type used in rheumatoid arthritis. The tricompartmental pros-

thesis can be used with or without a plastic component on the joint surface of the patella. In Sweden, both methods are equally common.

Comparisons between simultaneous bilateral knee arthroplasty and two stage surgery, have shown shorter care times, less bleeding, and no increase in risk [59].

Arthroplasty is a safe method to correct malalignment and restore stability and pain-free mobility. Good results require correct surgical management of soft tissues, restoration of a correct line of balance through the joint, restoration of the level and position of the patella, and correct cementation. The goal is to give the patient a flexion capacity of at least 105°, ie, that required to rise from a chair without assistance from the upper extremities.

Prosthetic complications are more difficult to master surgically in the knee than in the hip. Prosthetic exchange can be performed in one or two stages, as in the hip joint, but the functional results after such revision are seldom comparable to the results after primary surgery. There is nearly always the option of arthrodesis when prosthetic exchange, due to bone loss, is no longer possible.

Rehabilitation

Mobility training in hospital is seldom required for more than 10 days after open synovectomy or knee arthroplasty. Treatment with devices providing passive mobility training can restore the final range of motion to the patient somewhat more rapidly, but does not appear to yield better mobility [25]. Unweighting the knee with crutches for 3 to 6 weeks is recommended for some biologically anchored prostheses.

Surgical treatment results

Synovectomy

Synovectomy has good effects on problems generated by synovitis, ie, pain, aching, swelling, joint exudation, impaired mobility and function (Table 1). The effects are, however, less favorable if there is arthritic cartilage damage at the time of the procedure, so called late synovectomy [10,24,44]. This has also been noted in synovectomy with radioisotopes [6,57]. It appears that damage to the

cartilage, eg, erosion, can be arrested while the arthrosis-like reduction in the height of joint cartilage in stressed parts is not affected, but continues or begins following synovectomy and eventually leads to need for arthroplasty involving a prosthesis [23,24,36,38,58]. Synovectomy is associated with minor risks, most notably limitations in passive joint mobility due to scar formation in the capsule [36,55]. This unfavorable effect of open knee synovectomy is avoided by arthroscopy, which *per se* yields the same favorable outcome on symptoms caused by synovitis [27, 40,55,58].

Modern intraarticular cortisone agents have substantially reduced the need for synovectomy, and currently this procedure is motivated only for cortisone-resistant synovitis. There is no evidence that the procedure has any prophylactic effects on rheumatic joint destruction [36]. Mild resynovitis is observed in control arthroscopy already one year after open synovectomy, and, according to laboratory data, the degree of resynovitis does not correlate with the duration or the intensity of disease [45]. The subjective effects of the procedure are usually better than the objective effects. This is explained, in part, by the intermittent course of the disease where spontaneous improvement may occur after a period of active disease.

Arthroplasty

The goal of knee arthroplasty is to correct deformity, restore strength, mobility, and stability, and reverse arthritic symptoms, ie, discomfort, weighting-related pain, and swelling. Outcomes from this surgery are usually reported in terms of a "knee score", where the importance of various aspects are weighed against each other as in, eg, the HSS score. A modern scoring approach promoted by the American Knee Society is divided into a knee-related part and a more general part related to function. At times, established scoring systems are modified or new ones are introduced to better suit the purposes of the examining physician. Patients scoring above a given level are considered to have excellent results, and those scoring below are considered to have good results. The group with excellent and good results are presented under the "good" category in Table 2. Initially, the scores are markedly improved by the procedure, but tend to deteriorate after longer observation

Table 1. Clinical and radiologic results of knee joint synovectomy in RA

Reference	Joints	FU	Age	Synovectomy	Clinical	Before	After	Radiology	Before	After
Boerbooms et al. 1985	65	>3	>45	Early isotope	Good (1 year/ 3 yr) Operated at 3 year		55/37% 42%			
	24	3	>45	Late isotope	Good (1 year/ 3 yr) Operated at 3 year		37/20% 63%			
Brattström et al. 1985	508	13		Early open	Good		65%	Larsen	1.7	2.7
Mori 1985	103	10	47	Open	Less pain Less swelling Less mobility		75% 98% 64%	Progression		100%
Ishikawa et al. 1986 ^a	78	14		Open	Pain >mild Hydrops >mild Mobility	96% 93% 9–122°	31% 22% 5–123°	Joint space	4.4	3.5
	10	2	41	Open	Mobility	12–122°	5–114°	Progression		30%
Shibata et al. 1986 ^b	14	2	53	Arthroscopic	Mobility	3–125°	0–146°	Progression		28%
Sledge et al. 1987	25	2		Early isotope	Good		76%			
	34	2		Late isotope	Good		59%			
Klein & Jensen 1988 ^c	25	3		Arthroscopic	Pain ^c Swelling ^c Mobility ^c Gait ^c	46% 20% 36% 36%	82% 79% 77% 79%			
McEwen 1988 ^d	14	5		Open syn. (S) / Control (C)	More pain (S / C) Less pain (S / C) Active mobility Passive mobility	21 / 29% 71 / 50%				
							S>C S<C	Bone erosion Joint space		S<C S=C
Doets et al. 1989 ^e	83	7	54	Early (n 67) Late (n 16)	Good Good Worse ARA Reoperated		51% 13% 64% 43%			
Smiley & Wasilewski 1990 ^f	25	2		Arthroscopic	Good, own score Good (n 16) Good (n 11)	6 months 2 year 4 year	96% 90% 57%	Progression Progression		19% 38%
Jensen et al. 1991 ^g	55	6	61	Early open	Own score ^g Reoperated	8 (3–14)	4 (3–12) 4%			
				Late open	Own score ^g Reoperated	10 (7–15)	7 (3–15) 43%			
				Total	Pain at rest Painful walking	69% 85%	8% 50%	Only early changes	47%	19%
Ogilvie-Harris & Basinski 1991	96	2	43	Arthroscopic	Synovitis >mild Pain >mild Decreased function	86% 56% 62%	18% 24% 19%			
Paus et al. 1992 ^h	26	5	24	Open	Clinically improved Revised		100% 16%			

^a Mobility unchanged, less effect from late synovectomy, degree of activity of disease no significance

^b Arthroscopic synovectomy subjectively improved

^c Modified Lysholm score with percentage of maximum value

^d Comparison with nonoperated control material. In patients who are their own control no difference in resynovitis

^e Early = ARA classification I and II, late = ARA III. Good = good + fair. Early and late have the same reoperation rates

^f Own score based on pain relief, function, mobility, resynovitis, and hydrops

^g Own functional score: gait 7p, assistive devices 7p, and walking stairs 4p. Clinical gain only for early synovectomy

^h Colorado score based on function, pain, mobility, stability, and walking ability. 5-year result correlates to score and cartilage damage before and 1 year after synovectomy. Hence poor effect from late synovectomy

[18,13]. This has been explained, in part, by deterioration in other joints of the lower extremities, affecting the functional score. A substantial, but varying, number are free from pain, but the ability to walk 500 meters is achieved only by slightly more than 50% [1,3,21,32,33,49,59]. Preoperatively, less than 10% reportedly could manage the same distance [3,21,32,59].

Limitations in mobility include the inability to achieve full extension and maximum flexion (Table 3). Harvey et al studied how the Accord prosthesis affected mobility and found, like many others, that rheumatics gain in mobility (approximately 5°) with the exception of the most mobile, who lose somewhat [20,41]. The gains related to extension defect were greater the smaller the defect was preoperatively. Postoperative mobility was not affected by age, late mobilization, cementing, ligament release, or patellar component, but rather by previous synovectomy. Patients with stiff knees preoperatively, may also experience a substantial gain in mobility [2].

Fractures close to the prosthesis, supracondylar femur fractures in particular, present a problem in osteopenic rheumatic bones. The consequences, in most cases, involve limb shortening, malalignment, pain, and impaired walking ability. Furthermore, there is an increased risk for prosthetic loosening and pseudoarthrosis [7]. The treatment principles are conventional, ie, observing the risk for prosthetic infection as a complication of open surgery, and the risk of prosthetic complications from persistent malalignment.

Deep infection presents a serious complication since there is a risk of jeopardizing the knee joint. The infection risk has been estimated at 2.6 times higher than in comparable patients with arthrosis [46]. The risk for infection is greater when using large, long-shafted knee prostheses [28]. Increasingly more rheumatics are being treated with tri-compartmental prostheses, which have a lower risk of infection (2.2% according to Wilson et al [64]). In Sweden, this together with improved routines to prevent infection has resulted in less than a 1% risk of an infection requiring revision [50]. Furthermore, rheumatics have a tendency to acquire deep infections later than 3 years after the procedure, probably via blood borne infection since there is an association between this type of

infection and leg ulcers [46,50,64].

The loosening problem was reduced when tri-compartmental prostheses were introduced (Table 4). Component designs and cementing techniques have improved, and biological anchoring has been introduced, ie, without the use of bone cement. The claimed advantages of the latter method have not been confirmed concerning the attachment of the tibial component, which is most often affected by loosening, and according to Robertsson et al, a cemented tibial component is safer [50]. This was confirmed by radiostereometric analysis of Freeman-Samuelson prostheses with a tibial stem inserted with and without cement [4], but not in examination of Tricon-M prostheses with tibial peg fixation inserted with and without cement [39].

Translatory instability, ie, the femur sliding off the lower leg, was a problem with unicompartmental prostheses where the tibial joint surface is completely flat. Modern tricompartmental knees have a ridge to prevent sliding. Instability of the side ligaments does not appear to be a problem, not even with extensive ligament release during prosthetic procedures involving modern tricompartmental prostheses, probably because the guide instruments make it possible to concurrently restore the mechanical axis [12]. Furthermore, rheumatic patients have the advantage of developing minor adduction above the knee due to the effects of the disease on muscles and surrounding joints [9]. Sagittal instability may cause luxation, but this can be avoided by using correct surgical technique and the appropriate prosthesis, ie, use of sagittally stabilized prosthesis when needed

Patellar problems appear to be more dominant as other complications decrease. If a patellar component is not used, the risks for continued patellar joint pain, attrition of the patella, and subsequent patellar instability or luxation remain. If a patellar component is used, yet another particle-generating, thin plastic part is present which may wear and loosen. Furthermore, the osteopenic patella may be weakened by surgical preparation, hence increasing the risk for fracture. Opinions on the use of the patellar component are diametrical, and a comparative study did not show differences in pain relief or function [56]. Robertsson et al were unable to show differences in revision rates be-

Table 2. Outcome of knee arthroplasty in RA according to score system

Author/Score	Joints	Follow-up (years)	Prosthesis	Mean score		Good (%)	Pain free (%)
				Preop.	Postop.		
HSS score (Hospital for Special Surgery)^a							
Hvid et al. 1987	100	5	Insall-Burstein	45	83	87	82
Aglietti & Buzzi 1988	24	5	Insall-Burstein	38	81	88	92
Hanssen & Rand 1988	11	3	Kinematic Stabilized	53	82	100	—
	25	3	Kinematic revision	59	82	80	—
Rorabeck et al. 1988	18		Kinematic cemented	46	88	—	—
	6		PCA no cement	45	69	—	—
Stuart & Rand 1988	44	5	Misc. tricompart.	52	84	86	—
Hoekstra et al. 1989	13	6	Fyrleds cases	16	71	—	65
Ranawat et al. 1989	73	6	Total Condylar	46	87	99	—
Shoji et al. 1989	35	3	Y-S with patella	49	86	—	—
	35	3	Y-S without patella	50	86	—	—
Stern et al. 1989 ^b	24	4	Posterior stabilized	52	68	—	—
Laskin 1990	80	10	Total Condylar	64	85	—	79
Nilsson et al. 1991	9	2	Tricon-M, cement	43	88	—	—
	7	2	Tricon-M, no cement	39	84	—	—
Stuchin et al. 1991	53	3	Misc. tricompart.	47	88	91	—
Kristensen et al. 1992	71	10	Insall-Burstein	48	84	77	95
Rinonapoli et al. 1992	12	10	Total Condylar I	40	79	67	84
Partio et al. 1993	84	6	Townley	44	80	82	—
Low et al. (1994) ^b	34	4	Misc. TKR	41	87	—	—
Partio & vBonsdorff 1994	32	6	Synatomic no cement	—	83	90	—
Modified HSS							
Edwards et al. 1988 ^d	28	1–7	Misc. (1/3), stable	—	82	—	—
			Misc. (2/3), lax	—	89	—	—
Brugioni et al. 1990 ^e	10	4	Total Cond. cement	49	89	—	—
KS score, by knee score/functional score (Knee society)^f							
Firestone et al. 1992	23	>2	PCA, flexion contr. >20°	25/—	81/—	—	—
Partio & vBonsdorff 1994	32	6	Synatomic no cement	—	78/63	85/63	—
Aglietti et al. 1995	65	8	Insall-Burstein	23/25	90/55	95/29	74
Elke et al. 1995 ^g	61	4	PCA, 1 year	21/40	90/70	—	—
			3 years		83/68	—	—
			6–10 years postop.		70/64	—	—
Miscellaneous							
Tew & Foster 1987	468	1–16	Misc., flexion contr. >20°	—	—	—	76
			Misc., flexion contr. <5°	—	—	—	58
Goldberg et al. 1988	30	9	TC, (score 0–100), 4/9 yrs	33	92/85	—	—
Barrett et al. 1990	31	5	Oxford	—	—	67	—
Wright et al. 1990	96	5–9	Kinematic (score 0–100)	39	88	88	—
Ebert et al. 1992	33	6	PCA cement (score 0–100)	29	84	81	—
	69	5	PCA no cement	38	93	91	—

^a HSS score includes mobility, stability, strength, position, freedom from pain and ache, function, and need of walking assistance

^b Psoriasis only

^c Reactivation of RA 2 years after knee arthroplasty (7%), synovectomy decreases the risk

^d Comparison between ligamentary stable and lax knees. HSS modified to exclude points for stability

^e Gait analysis shows poor adduction and short step length in rheumatics compared to healthy individuals

^f Knee Society knee score: pain 50p, mobility 25p, stability 25p + deduction for extension defect and instability. Knee Society functional score: gait 50p, stairs 50p + deduction for assisted walking

^g Postoperative score measured at 1, 3, and 6-10 years. Uncemented and patellar component with metal posterior piece worse

tween two equally large groups (1400 cases each) with and without the patellar component [50]. Attempts have been made to predict postoperative

patellar pain for selective use of patellar components, and it was found that a low-riding patella (≤ 15 mm above the joint plane) should be re-

Table 3. Mobility after knee arthroplasty in RA

Author	Joints	Follow up (years)	Prosthesis	Measurement	Preoperative		Postoperative	
					Mean	Range ^a	Mean	Range ^a
Schurman et al. 1985 ^b	33	>2	Total Cond.		—	17°–107°	—	6°–99°
Aglietti & Buzzi 1988	24	5	Insall-Burstein		—	20°–90°	—	4°–98°
Hanssen & Rand 1988	11	3	Kinematic Stabil.		—	9°–105°	—	3°–104°
Rorabeck et al. 1988	18		Kinematic cement		—	4°–107°	—	1°–104°
	6		PCA no cement		—	5°–101°	—	13°–88°
Stuart & Rand 1988	44	5	Misc. tricompartmental		—	21°–99°	—	4°–95°
Aglietti et al. 1989	6	5	Total Cond. Post. Stabil.		<50°	—	78°	10°–88°
Hoekstra et al. 1989	13	6	Fyrleds cases		—	25°–54°	—	2°–81°
Shoji et al. 1989	35	3	Yoshino-Shoji with patella		97°	—	119°	—
	35	3	Yoshino-Shoji without patella		96°	—	115°	—
Barrett et al. 1990	31	5	Oxford		—	–93°	—	–103°
Laskin 1990	80	10	Total Cond.		87°	—	96°	—
Stanley et al. 1990	100	3	Insall-Burstein		—	—	100°	—
Wright et al. 1990	96	5–9	Kinematic		—	–106°	—	–109°
Nilsson et al. 1991	9	2	Tricon-M, cement		—	19°–111°	—	3°–115°
	7	2	Tricon-M, no cement		—	17°–98°	—	4°–111°
Ebert et al. 1992	33	6	PCA cement		80°	7°–	94°	2°–
	69	5	PCA no cement		89°	12°–	102°	5°–
Firestone et al. 1992 ^c	23	>2	PCA, flexion contracture	>20°	—	29°–89°	—	9°–88°
Kristensen et al. 1992	71	10	Insall-Burstein		—	—	98°	—
Parsley et al. 1992	5	>1	Misc. tri, flexion preop.	<75°	—	–52°	—	–68°
	11	>1	Misc. tri, flexion preop.	75°–95°	—	–87°	—	–87°
	59	>1	Misc. tri, flexion preop.	>95°	—	–117°	—	–112°
Rinonapoli et al. 1992	12	10	Total Cond. I		—	—	89°	—
Harvey et al. 1993	168	1–4	Accord		—	–97°	—	–102°
Tew & Foster 1987 ^d	468	1–16	Misc., flexion. contracture	>20°	36%		3%	
			Misc., flexionr. contracture	<5°	39%		84%	
Elke et al. 1995	61	4	PCA, flexion	>90°			58%	

^a Extent: average extension defect to average maximum flexion

^b Extension gain immediately, flexion gain takes 1 year

^c Only cases with >20° flexion contracture, immediately postoperative only 3° flexion contracture, then worse

^d Preoperative flexion contracture yielded lower revision rate. Postoperative flexion contracture constant over time

placed [14]. Followup of the height of the patella above the joint plane, calculated as the ratio of this measurement and the proper length of the patella, show that the patellar ligament shrivels after the procedure and reduces the height from 0.93 before knee arthroplasty to 0.79 one year after the procedure [31]. The risk for a patellar fracture after a knee arthroplasty has been calculated at 0.2%, with half yielding good clinical results [17]. Avascular necrosis of the patella may arise in knee arthroplasty, especially if the capsule is also divided on the lateral side to enable the patella to glide correctly. Necrosis is followed by collapse of the patella with risk for fracture and component loosening, with revision as a consequence [22].

Varying followup times, and occasionally the large number of dropouts, make it difficult to evaluate comparisons between databases. Some of

these deficiencies are corrected in calculation of revision frequency by survivorship methods (Table 5). Prosthetic survival exceeding 90% at 10-year followup appears to be reasonable with the modern tricompartmental prostheses.

References

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Table 4. Local complications after knee arthroplasty in RA

Author	Joints	Follow-up up (years)	Prosthesis	Infection (%)	Radiol. loose- ning (%)	Revised loose- ning (%)	Other problems (%)	Patella (%)	Wound problems (%)
Knutson et al. 1986	270	1-10	Hinge	7 rev.	—	6	2 rev.	—	—
	296	1-10	Stabilized	2 rev.	—	3	1 rev.	—	—
	1 962	1-10	Bi/tricomp.	2.1 rev.	—	2.6	1.0 rev.	—	—
	745	1-10	Double unicomp.	1 rev.	—	6	5 rev.	—	—
Hvid et al. 1987	100	5	Insall-Burstein	3 rev.	2	0	—	1 rev	5
Aglietti & Buzzi 1988	24	5	Insall-Burstein	0	4 susp.	—	—	20 pain	25
Goldberg et al. 1988	30	9	Total Condylar	0	—	12 tibial	—	—	12
Hanssen & Rand 1988	11	3	Kinematic stabil.	0	0	0	—	—	—
	25	3	Kinematic revision	0	8	8	—	—	—
Stuart & Rand 1988	44	5	Misc. tricomp.	0	0	0	—	4 compl	—
Hoekstra et al. 1989	13	6	4 joint cases	0	0	0	0	0	—
Stern et al. 1989 ^a	24	4	Posterior stabil.	16 rev.	—	4	—	—	12
Barrett et al. 1990	31	5	Oxford uni	0	—	6	—	0	—
Laskin 1990	80	10	Total Condylar	6 rev.	9	15 tibial	—	1 loose	—
Wilson et al. 1990	2 076		Misc. tricomp.	2.2	—	—	—	—	—
Stanley et al. 1990	64	3	I-B, simultan. surg.	0	—	—	—	—	—
	36	3	I-B, 2-stage surg.	11 rev.	—	—	—	—	—
Wright et al. 1990	96	5-9	Kinematic	0	0	—	—	10 rev.	—
Beyer et al. 1991 ^a	50	4	Misc.	2	—	8	—	—	0
Moran et al. 1991	73	5	PCA no cement	0	18 tibial	—	—	—	—
Stuchin et al. 1991	53	3	Misc. tricomp.	0	2	—	—	2	0
Ebert et al. 1992	33	6	PCA cement	0	0	3 tibial	—	0	2
	69	5	PCA no cement	1 rev.	0	3 tibial	—	3 rev.	1
Firestone et al. 1992	23	>2	PCA, >20° flex.contr.	0	4 tibial	—	9 contr.	0	—
Kristensen et al. 1992	71	10	Insall-Burstein	7 rev.	—	4	—	1	—
Partio et al. 1993	84	6	Townley	3	8	6 tibial	—	—	10
Low et al. 1994	34	4	Misc. tricomp.	3	0	0	—	3 disloc.	—
Partio & v Bonsdorff 1994	32	6	Synatomic, no cem.	3 rev.	0	3 tibial	—	3 loose	6
Aglietti et al. 1995	65	8	Insall-Burstein	5 rev.	0	0	—	7 pain	—
Elke et al. 1995	61	4	PCA	3 rev.	0	3	—	3 rev.	—
Kolstad et al. 1996 ^b	55	16	Marmor double	4 rev.	0	15	9 rev.	—	—
Robertsson et al. 1996	1 776	5	Tri 1985-1989	1.2 rev.	—	1.7	1.0 rev.	0.5 rev.	—
	1 976	2	Tri 1990-1994	0.6 rev.	—	0.2	0.5 rev.	0.3 rev.	—
	189	5	Uni 1985-1994	1 rev.	—	5	5 rev.	1 rev.	—

^a Psoriatic patients^b No correlation to age, weight, previous surgery, revision surgery, prosthetic type, cement, but men have a doubled risk. Leg ulcers involve a high risk (in 20% of infected, 3% of non-infected). Steroids show a trend of $p=0.09$. Later infection in RA

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Table 5. Cumulative risk for prosthesis revision according to survival analysis

Author	n	End-point	Prosthesis	Percent affected		
				5 years	7 years	10 years
Knutson et al. (1985)	184	Revision	Unicompartmental	23	—	28
	92	Revision	Bi-/tricompartamental	0	—	—
	89	Revision	Stabilized	14	—	—
	64	Revision	Hinge	16	—	24
Knutson et al. (1986)	270	Revision	Double unicomp.	15	—	—
	1962	Revision	Bi-/tricompartamental	9	—	—
	296	Revision	Stabilized	10	—	—
	170	Revision	Hinge	16	—	—
Ranawat et al. (1989)	73	Revision	Total Cond., < 55 yrs	—	—	0
		Failure		—	—	2
		Rev. + reop.		—	—	8
Scuderi et al. 1989	?/ 193	Revision	Total Condylar	0	5	11
	?/ 193	Revision	Tot. Cond. Stab. plastic tibial	3	3	3
	?/ 193	Revision	Tot. Cond. Stab. metal tibial	0	0	—
Laskin 1990	80	Revision	Total Condylar	6	10	19
		Revision + loose	Total Condylar	7	12	25
Moran et al. 1991	73	Revision	PCA no cement	17	—	—
Rand & Ilstrup 1991	2876	Revision	Misc.	7	—	18
	779	Revision	Tricomp., non-stab, metal tibial	2	—	—
	66	Revision	Tricomp. revision, metal tibial	2	—	—
Aglietti et al. 1995	65	Revision	Insall-Burstein	1	—	4
Elke et al. 1995	61	Revision	PCA, peg- and stem model	9	—	19
Kolstad et al. 1996	55	Revision	Double Marmor	8	27	—
Robertsson et al. 1996	1776	Revision	Tricomp. 1985–1989	4	—	5
	1976	Revision	Tricomp. 1990–1994	2	—	—
	189	Revision	Unicomp. 1985–1994	16	—	—
		Revision	Tricomp., <55years	4	—	8
		Revision	Tricomp., ≥55years	3	—	4

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